

Methods in Evolutionary Biology and Molecular Ecology
BIOS 716/EVPP 615
Lecture 4:30-7:10
Lab 7:20-10:00

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Description:

The course is geared to students who plan on doing research in Molecular Ecology, Molecular Evolution, Conservation Genetics, Genomics, and Biocomplexity. This course is based on the introduction provided by BIOS 515. The lecture reviews the basic concepts of Molecular Biology, Genetics, Molecular Evolution, covered in BIOS 515. The detailed protocols for DNA extractions, Polymerase Chain Reactions (PCR), Fluorescent sequencing, Microsatellite fingerprinting, and NextGen sequencing will be covered. These protocols will then be implemented in the lab section. Bioinformatics analysis will be expanded to cover the algorithmic basis for the most common methodologies. An introduction will be given to computer science and the basic hardware and operation system of computers. Finally, we cover basic PERL scripting, commercial analytical packages, and WEB based analysis tools.

The course is integrated to combine, theory, protocols, and analysis in a pragmatic applied paradigm. The lecture section will be a combination of theoretical reviews and Bioinformatics exercises. The lab section will utilize cutting edge technologies and instrumentation in the field.

Prerequisites: Molecular Ecology BIOS 715 or consent of the instructor.

Course Textbooks and Materials:

An Introduction to Molecular Ecology, Trevor Beebee & Graham Rowe 2008
Bioinformatics for Beginners, Supratim Choudhuri 2014

Other reading will be assigned from the literature and from the Web.
Blackboard will be used to distribute lectures and assignments.

Other reference Books:

Bioinformatics: Sequence and Genome Analysis, David Mount 2004
Molecular Cell Biology, Lodish et al, W.H. Freeman and Company, Fifth Edition 2004
Molecular Ecology J.R Freeland
Molecular Methods in Ecology A.J. Baker et al

Credits: This course carries 3 lecture credits and 1 lab credit.

Grading:

Grades will be based on class interaction (10%) and a combination of lab reports, Standard Working Protocols, and Analysis reports each week. Assignments are due the following week they are posted.

Class interaction will be measured by participation in class meetings and by participation in on-line discussions.

Computer resources:

You will need to have access to email and the web to access assignments.

Blackboard will be used to distribute lectures and assignments

All of these resources are available to GMU students at PWI and elsewhere.

You may also need to read WWW documents in *.pdf (Adobe Acrobat).

Readers are available for free for Windows, Macintosh and many unix platforms at the Adobe website.

Grading Scale

Letter Grade	Percentage	Registrar's Equivalent on a Scale of 0-4.0
A+	> 96	4.0
A	92.0-96.0	4.0
A-	90.0-91.99	3.67
B+	88.0-89.99	3.33
B	82.0-87.99	3.00
B-	80.0-82.0	2.67
C	70.0-77.99	2.00
F	< 70	0.00

Academic Integrity

GMU is an Honor Code university; please see the University Catalog for a full description of the code and the honor committee process. The principle of academic integrity is taken very seriously and violations are treated gravely. What does academic integrity mean in this course? Essentially this: when you are responsible for a task, you will perform that task. When you rely on someone else's work in an aspect of the performance of that task, you will give full credit to those people in the proper, accepted form. When doing homework, the work must be yours. It is totally unacceptable to copy the work of another student in this course in any form.

GMU Email Accounts

Students must use their Mason email account to receive important University information, including messages related to this class. See <http://masonlive.gmu.edu> for more information. Students will need to have access Blackboard for class lectures and assignments,

Other Useful Campus Resources:

Writing Center: A114 Robinson Hall; (703) 993-1200; <http://writingcenter.gmu.edu>

UNIVERSITY LIBRARIES "Ask a Librarian" <http://library.gmu.edu/mudge/IM/IMRef.html>

Counseling and Psychological Services (CAPS): (703) 993-2380; <http://caps.gmu.edu>

University Policies

The University Catalog, <http://catalog.gmu.edu>, is the central resource for university policies affecting student, faculty, and staff conduct in university academic affairs. Other policies are available at <http://universitypolicy.gmu.edu/>. All members of the university community are responsible for knowing and following established policies.

Tentative Schedule

S18		Molecular Ecology II - Environmental Biology II BIOS716 - EVPP615 COURSE SCHEDULE	ASSIGNMENTS
Thursday			
25-Jan	Lecture	Introduction and Course Plan	
	no Lab	Literature Search	
		Medline & GMU Library	
		Endnotes & Mendeley & Zotera	
	Computer Lab I:	Unix Intro I & Intro to Galaxy	
1-Feb	Lecture	Review of Restriction Digestion	
	Lab 1	Restriction Digestion Reactions	Standard Working Protocol I
		Electrophoresis making Agarose gels	Restriction Digestion Analysis I
		Visualizing Restriction Digestions on Agarose Gel	Due next week
	Computer Lab II:	Kodak 1D analysis and Restriction mapping	
8-Feb	Lecture	Review of DNA Extraction: Bio101 Soil & Tissue	
	Lab 2	DNA extraction (Soil & Sediment samples)	
		Make a 1% Agarose Gel	
		Quantitation of DNA on Agarose gel	
	Computer Lab III :	Introduction to PERL Programing	
15-Feb	Lecture	Overview of PCR & LH PCR Fingerprinting	
	Lab 3	PCR on 16S rRNA for soil community for Fingerprinting	
	Computer Lab IV :	PERL Programing	
22-Feb	Lecture	ABI3130 & Overview of LH PCR & Fingerprint Analysis	
	Lab 4	Visualization of PCR products from last week on Agarose gel (done before class)	Analysis I
		Prepare dilutions of PCR products for Fingerprinting (Demo)	LH-PCR assignment
		Run fingerprints on ABI 3130xl capillary (Demo)	Due next week
		LH-PCR Analysis: Genemapper	
	Computer Lab V:	Galaxy/Portal Tools/Create tools : Excel Histograms	
1-Mar	Lecture	Microbial Community Analysis	Analysis II
	Lab 5	Run PCRs for Cloning experiment next week.	Community analysis-Histograms
	Computer Lab VI:	Galaxy Tools for Microbial community analysis	Due next week
8-Mar	Lecture	Over view of Topo TA Cloning	
	Lab 6	Cloning of PCR products using TOPO-TA cloning kit	
	Computer Lab VII:	Review of Blast analysis and RDP11 Bayesian Analysis	
15-Mar	SPRING BREAK (March 12-16)		
22-Mar	Lecture	Transformation efficiency & Overview of plasmid prep	Standard Working Protocol II
	Lab 7	Pick colonies, lyse colonies	Cloning Protocol
		Run PCR on lysed colonies using M13 primers	Due next week
	Computer Lab VIII:	Geneious Analysis : LEFSE METASTATS UNIFRAC	
29-Mar	Lecture	Overview of Sequencing	
	Lab 8	Run PCRs from clones on agarose gel (done before class)	Standard Working Protocol III
		Purify PCR products with Ampure solution	Sequencing Protocol
		Run cleaned PCRs on 1% agarose gel	Due next week
		Run sequencing reactions on purified PCR products	
	Computer Lab IX:	Qlime	
5-Apr	Lecture	Review Gel Filtration purification method	Analysis III
	Lab 9	Cleanup sequencing reactions with Sephadex (done before class)	Galaxy assignment
		Dry sequencing reaction in speed vac	
		Run Sequencing Reactions on Capillary machine (ABI 3130XL)	Due next week
	Computer Lab X:	Sequencher	
12-Apr	Lecture	Review Sequence Analysis & Assembly	RDP11 Histograms on Clone data
	Lab 10	Analyze sequence data on ABI 3130XL	Due next week
		Prepare sequence data for Sequencher	
	Computer Lab XI:	RDP11 analysis on clone data	
19-Apr	Lecture	PGM Sequencing & Microbiome	RDP11 Histograms on NextGen data
	Lab 11	Nextgen sequencing (Demos for PGM)	NextGen technology
		Demo: GS Junior Run Browser & PGM software	Due next week
	Computer Lab XII:	UPARSE analysis on demultiplexed data	
26-Apr	Lecture	Swan Project	Literature Review 1
	Lab 12	Popgen	Students Choice
	Computer Lab XIII:	Microsat Commander	
3-May	Lecture	Selfish Microbiome	
	Computer Lab XIV:	Correlation Network Analysis / Metagenome Analysis (MG-Rast) PICRUST	